INDOOR AIR QUALITY ASSESSMENT

Lexington Town Hall
1265 Massachusetts Avenue
Lexington, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program
April 2006

Background/Introduction

At the request of Derek Fullerton, Director, Lexington Health Department, the Massachusetts Department of Public Health (MDPH), Center for Environmental Health (CEH) provided assistance and consultation regarding indoor air quality concerns at the Lexington Town Hall (LTH), 1265 Massachusetts Avenue, Lexington, Massachusetts. The request was prompted by concerns of mold growth, odors and poor indoor air quality in the building. On February 22, 2006, an indoor air quality assessment at the LTH was made by Cory Holmes, an Environmental Analyst in CEH's Emergency Response/Indoor Air Quality (ER/IAQ) Program. The LTH is a three-story, red brick building constructed in 1929. An addition was built in the 1970s and the building has undergone interior renovations over the years. Windows are openable throughout the building. The building contains town offices and public meeting rooms. The basement of the building contains a workout room and storage areas.

Methods

Air tests for carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor. CEH staff performed a visual inspection of building materials for water damage and/or microbial growth. Moisture content of porous building materials (i.e., wall plaster and carpeting), were measured with Delmhorst, BD-2000 Model, Moisture Detector with a Delmhorst Standard Probe.

Results

The LTH has an employee population of approximately 65 and is visited by approximately up to 200 individuals daily. The tests were taken during normal operations. Test results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were above 800 parts per million (ppm) in twenty-two of forty-four areas surveyed, indicating poor air exchange in half of the areas surveyed during the assessment. It is important to note that mechanical ventilation systems were deactivated at the time of the assessment. It is also important to note that several areas that had carbon dioxide levels over 800 ppm were unoccupied or sparsely populated, which further indicates a lack of air exchange.

Mechanical ventilation is provided by two air-handling units (AHUs) located in the attic. Fresh air is drawn into the AHUs through an air intake located on the exterior of the building (Picture 1) and delivered to occupied areas via ceiling-mounted air diffusers (Picture 2). Return air is drawn into ceiling-mounted vents and ducted back to the AHUs. These systems were deactivated during the assessment.

Fan coil units (FCUs) located along perimeter walls (Picture 3/Figure 1) provide supplemental heating or cooling as needed for each room. However, FCUs do not have the capability to introduce outside air; rather they re-circulate air. These units were deactivated in the majority of areas surveyed during the assessment. A number of FCU air diffusers and/or return vents throughout the building were obstructed by various items, which limits air circulation.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). Town officials reported that the system was balanced approximately a year prior to the MDPH assessment.

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The MDPH uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see Appendix A.

Temperature readings ranged from 67° F to 75 ° F, which were below the MDPH recommended comfort guidelines in some areas. The MDPH recommends that indoor air temperatures be maintained in a range of 70 ° F to 78 ° F in order to provide for the comfort of building occupants. Temperature control and poor airflow complaints were expressed in several areas. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply. In addition, it is difficult to control temperature and maintain comfort without operating the ventilation equipment as designed (e.g., AHUs and FCUs deactivated/obstructed).

The relative humidity measured in the building ranged from 19 to 30 percent, which was below the MDPH recommended comfort range in all areas surveyed the day of the assessment. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

As a result of plumbing leaks in the Tax Collectors office, sections of water damaged wall plaster were replaced. CEH staff removed the vinyl coving at the base of the wall to inspect wall plaster and observed visible mold growth (Pictures 5 and 6). In addition, CEH staff conducted moisture testing of water damaged wall plaster. In order for building materials to support mold growth, a source of water exposure is necessary. Identification and elimination of water moistening building materials is necessary to control mold growth (in this case a plumbing leak). Materials with increased moisture content *over normal* concentrations may indicate the possible presence of mold growth. At the time of the assessment the wall plaster behind the coving was found to have an elevated (i.e., saturated) moisture content when compared to uncovered plaster walls (Table 1). The vinyl coving serves as an impermeable barrier that traps moisture behind it, preventing wet materials from drying. Carpeting tested in this area was found to have low (i.e., normal) moisture content (Table 1), at the time of the assessment.

Repeated water damage to porous building materials (e.g., wallboard, ceiling tiles, and carpeting) can result in microbial growth. The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend that porous materials be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH, 1989). If not dried within this time frame, mold growth may occur. Once mold has colonized porous materials, they are difficult to clean and should be removed.

Water damaged wall plaster and efflorescence were observed in the Town Clerk's (Picture 7) and Town Manager's offices. At the time of the assessment these areas were found to have low (i.e., normal) moisture content (Table 1). Water damage is most likely the result of water penetration through the building envelope. Efflorescence is a characteristic sign of water damage to brick and mortar, but it is not mold growth. As moisture penetrates and works its way through mortar and brick, water-soluble compounds in mortar and brick dissolve, creating a solution. As the solution moves to the surface of the mortar or brick, the water evaporates, leaving behind white, powdery mineral deposits. During a perimeter inspection of the building, missing/damaged mortar around exterior brickwork was observed in several areas (Pictures 8 and 9).

A number of areas had water damaged ceiling tiles (Picture 10), which can indicate leaks from the roof or plumbing system. Water damaged ceiling tiles can provide a source of mold and should be replaced after a water leak is discovered and repaired.

Water coolers were located over carpeting (Picture 11) in some areas. Water spillage or overflow of cooler catch basins can result in the wetting of the carpet. In addition, some of the coolers had residue/build-up in the reservoir. These reservoirs are designed to catch excess water during operation and should be emptied/cleaned regularly to prevent microbial and/or bacterial growth.

Plants were noted near FCU air diffusers in several areas. Plants should be properly maintained and equipped with drip pans. Plants should be located away from ventilation sources to prevent aerosolization of dirt, pollen or mold. Plants should not be placed on porous materials, since water damage to porous materials may lead to microbial growth.

Other Concerns

Several other conditions that can potentially affect indoor air quality were also identified. FCUs are equipped with filters that provide filtration to strain particulates from airflow. Many of the FCUs in the LTH did not have racks into which filters could be fit properly. Filters were observed on the floor beneath units or hanging out of units (Picture 12). Some FCUs had metal/mesh filters installed (Picture 13), which are difficult and time consuming to clean. A number of FCUs had accumulated dirt, dust and debris on FCU air diffusers (Picture 14) and within the air handling chambers. These conditions may be attributed to non-continuous operation, which allows airborne particulates to settle within the units. In order to avoid equipment serving as a source of aerosolized particulates, the air handling sections of FCUs should be cleaned regularly (e.g., during regular filter changes). A number of supply vents (Picture 2), return/exhaust vents (Picture 15), and personal fans (Picture 16) in offices and restrooms also had accumulated dust. If exhaust vents are not functioning, backdrafting can occur, which can re-aerosolize dust particles. Dust can also become aerosolized from supply vents and personal fans when activated.

The filters installed in the AHUs and FCUs at the LTH are of a type that provides minimal filtration (Pictures 13, 17 and 18). In order to decrease aerosolized particulates, higher efficiency, disposable filters can be installed in AHUs and FCUs. The dust spot efficiency is the ability of a filter to remove particulates of a certain diameter from air passing through the filter. Filters that have been determined by ASHRAE to meet its standard for a dust spot efficiency of a minimum of 40 percent would be sufficient to reduce airborne particulates (Thornburg, 2000; MEHRC, 1997; ASHRAE, 1992). Note that increased filtration can reduce airflow produced through increased resistance (called pressure drop). Prior to any increase in filtration, AHUs and FCUs should be evaluated by a ventilation engineer to ascertain whether they can maintain function with more efficient filters. It is also important to note that one of the AHUs located in the attic that MDPH staff found to be extremely difficult to access. To service the AHU, LTH maintenance staff reportedly have to cross a dimly lit, unfinished attic space with a low ceiling while walking across floor joists.

Musty odors were reported by occupants and detected by CEH staff in several areas of the building, primarily in the second and ground floor hallways. In both cases, the distribution of odors appeared to be more prevalent with the operation of FCUs. CEH staff observed conditions in the FCUs and found open utility holes in the base of the cabinets (Picture 19). The operation of FCUs can draw air from wall/floor cavities and adjacent areas through these open utility holes, and distribute these odors throughout the building. In addition, the FCU in the ground floor men's room was in close proximity to the floor drain (Picture 20). Drains are usually designed with traps in order to prevent the back up of sewer odors/gases from penetrating into occupied spaces. When water enters a drain, the trap fills and forms a watertight seal. Without a watertight seal, odors can travel up the drain and enter the occupied space. The operation of the FCU in the men's room not only accelerates the drying out of the floor drain trap, but also serves to *pressurize* the restroom, which can force restroom odors into adjacent areas.

A number of areas contained photocopiers. Volatile organic compounds (VOCs) and ozone can be produced by photocopiers, particularly if the equipment is older and in frequent use. VOCs are materials, which evaporate readily and can be irritating to eyes, nose and throat. Ozone is a respiratory irritant (Schmidt Etkin, 1992). Photocopiers should be located near local exhaust ventilation or in well-ventilated areas to remove/reduce excess heat and odors.

Also of note was the amount of materials stored inside offices. In areas throughout the building, items were observed on windowsills, tabletops, counters, bookcases and desks. The large number of items stored provides a source for dusts to accumulate. These items, (e.g., papers, folders, boxes) make it difficult for custodial staff to clean. Dust can be irritating to eyes, nose and respiratory tract. Items should be relocated and/or be cleaned periodically to avoid excessive dust build up.

Lastly, exposed fiberglass insulation was observed around pipes and above missing ceiling tiles (Pictures 20 and 21). Fiberglass insulation can provide a source of skin, eye and respiratory irritation.

Conclusions/Recommendations

The conditions noted at the LTH raise a number of indoor air quality issues. The lack of operation of the mechanical ventilation system and its components can limit air exchange in the building. Lack of environmental pollutant dilution and/or removal by the ventilation system can result in the build up and concentration of such pollutants in occupied areas and lead to air quality/comfort complaints. General building conditions, design and the operation (or lack) of HVAC equipment, if considered individually, present conditions that could degrade indoor air quality. When combined, these conditions can serve to further negatively affect indoor air quality. Some of these conditions can be remedied by actions of building occupants. Other remediation efforts will require alteration to the building structure and equipment. For these reasons a two-phase approach is required. This approach consists of **short-term** measures to improve air quality and **long-term** measures that will require planning and resources to adequately address overall indoor air quality concerns.

The following **short-term** measures should be considered for implementation:

1. Operate ventilation systems that are designed for heating/cooling continuously and in their appropriate modes during periods of occupancy.
2. Remove all blockages from FCUs and operate to facilitate airflow.
3. Supplement airflow by using openable windows to control for comfort (with the exception of during the cooling season when AC is activated). Care should be taken to ensure windows are properly closed at night and weekends to avoid the freezing of pipes and potential flooding.
4. Consider installing local exhaust ventilation for photocopiers and in restrooms.
5. Consider balancing mechanical ventilation systems every 5 years, as recommended by ventilation industrial standards (SMACNA, 1994).
6. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of

all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

7. Replace all water damaged/mold colonized wall plaster in the Tax Collector's office. This measure will remove actively growing mold colonies that may be present. Remove carpeting in this area to inspect for mold growth. This work should be conducted at a time when occupants are not present in the area. Once work is completed, ensure that the area is thoroughly cleaned and disinfected with an appropriate antimicrobial. Renovation generated dust and particulates in carpeted areas should be vacuumed with a HEPA filtered vacuum cleaner.
8. Mold remediation should be conducted in a manner consistent with recommendations in "Mold Remediation in Schools and Commercial Buildings" published by the US Environmental Protection Agency (US EPA, 2001). This document can be downloaded from the US EPA website at: http://www.epa.gov/iaq/molds/mold_remediation.html.
9. Replace/repair any remaining water-stained ceiling tiles. Examine the area above and around these areas for mold growth. Disinfect areas of water leaks with an appropriate antimicrobial.
10. Contact a masonry firm or general contractor to repair holes/breaches in exterior walls to prevent water penetration, drafts and pest entry.
11. Ensure all plants are equipped with drip pans. Examine drip pans for mold growth and disinfect areas of water leaks with an appropriate antimicrobial where necessary. Move plants away from ventilation sources.

12. Relocate or place tile or rubber matting underneath water coolers in carpeted areas. Clean and disinfect reservoirs as needed to prevent microbial growth.
13. Contact the manufacture of FCUs or HVAC engineering firm to determine appropriate size and installation of filters.
14. Change filters for air-handling equipment as per the manufacturer's instructions or more frequently if needed. Vacuum interior of units prior to activation to prevent the aerosolization of dirt, dust and particulates. Ensure filters fit flush in their racks with no spaces in between allowing bypass of unfiltered air into the units.
15. Consider upgrading to higher efficiency pleated filters.
16. Consider installing hatchway for easier access for maintenance of attic AHUs.
17. Seal utility holes in floors of FCU cabinets as well as other areas of the building (Picture 22) to prevent the migration of odors.
18. Develop and implement a protocol to fill floor drains (e.g., twice a week) to maintain the integrity of the traps.
19. Deactivate FCU fan in the ground floor men's room to prevent pressurization. If additional heat is needed, consider installing a wall-mounted electric heater such as in the work out room.
20. Wrap heating pipes and replace missing/damaged ceiling tiles to prevent exposure to fiberglass insulation and other particulates.
21. Relocate or consider reducing the amount of materials stored in offices and common areas to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.

22. Clean air diffusers, FCU return vents, personal fans and exhaust vents periodically of accumulated dust.

23. Consider cleaning carpeting annually (or semi-annually in soiled high traffic areas) as per the recommendations of the Institute of Inspection, Cleaning and Restoration Certification (IICRC). Copies of the IICRC fact sheet can be downloaded at: http://www.cleancareseminars.com/carpet_cleaning_faq4.htm (IICRC, 2005)

24. For further building-wide evaluations and advice on maintaining public buildings, see the resource manual and other related indoor air quality documents located on the MDPH's website at http://mass.gov/dph/indoor_air.

The following **long-term measures** should be considered:

1. Consider contacting an HVAC engineering firm for a full evaluation of the ventilation system for proper operation and/or repair. This recommendation is strongly suggested, considering the difficulty of temperature control reported by occupants and the resulting lack of operation of the HVAC system.

2. Consider having exterior walls re-pointed and waterproofed to prevent water intrusion. This measure should include a full building envelope evaluation.

References

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Picture 1

Fresh Air Intake for HVAC System

Picture 2

Ceiling-Mounted Air Diffuser, Note Dust Accumulation on Diffuser and Ceiling Tiles

Picture 3

Fan Coil Unit

Picture 4

Various Items on and in front of FCU Obstructing Airflow

Picture 5

Water Damaged Wall Plaster and Visible Mold Growth behind Vinyl Coving (Removed by CEH staff) In Tax Collectors Office

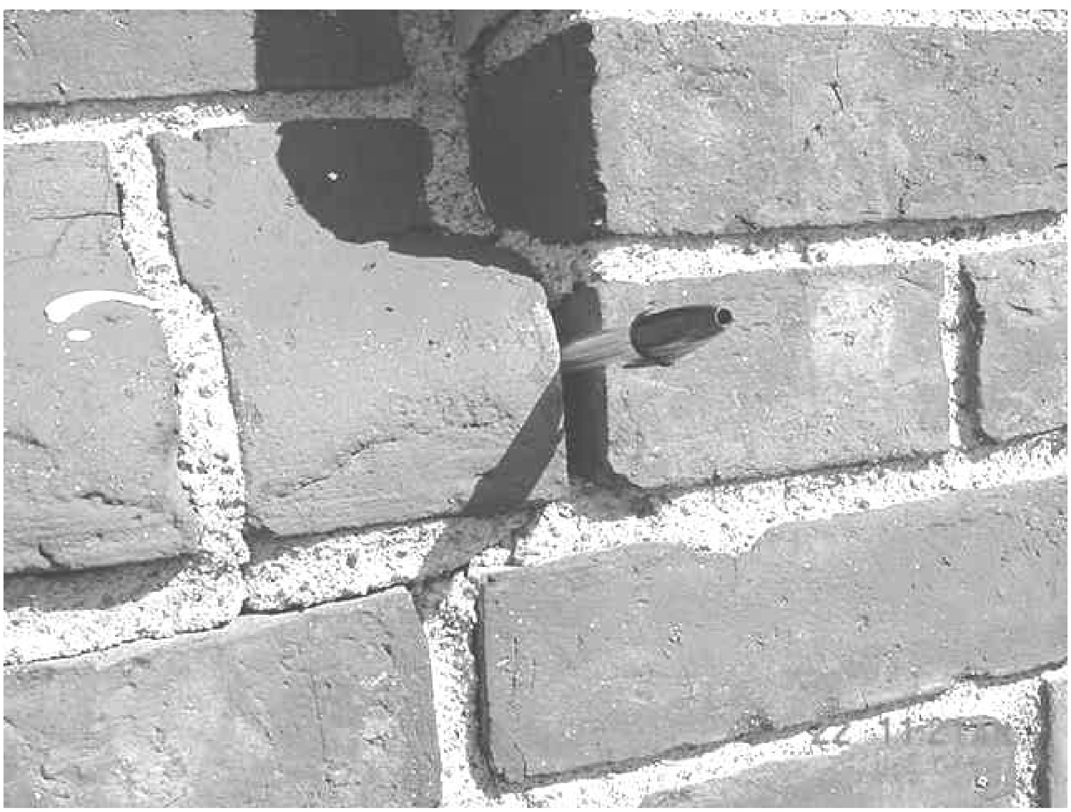
Picture 6

Close-up of Water Damaged Wall Plaster and Visible Mold Growth behind Vinyl Coving (Removed by CEH staff) In Tax Collectors Office

Picture 7

Peeling Paint and Efflorescence in Town Clerks Office

Picture 8



Missing/Damaged Mortar around Brick, Pen Inserted by CEH Staff to Show Depth

Picture 9

Missing/Damaged Mortar around Brick, Pen Inserted by CEH Staff to Show Depth

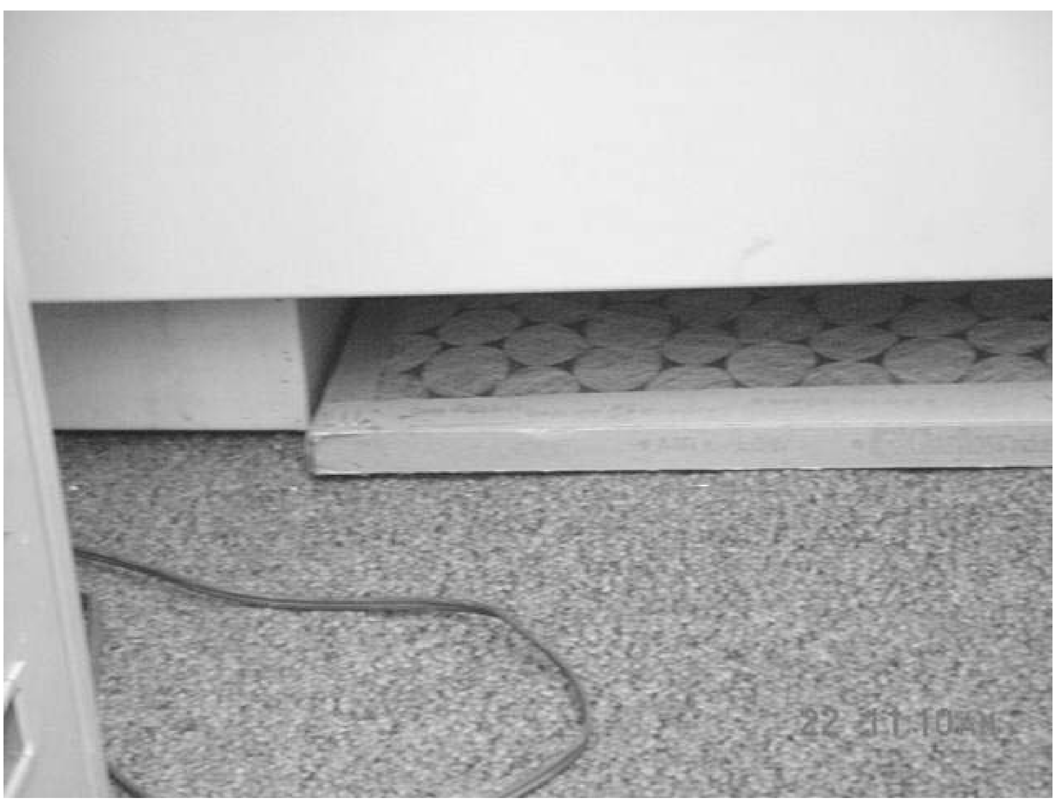
Picture 10

Water Damaged Ceiling Tiles

Picture 11

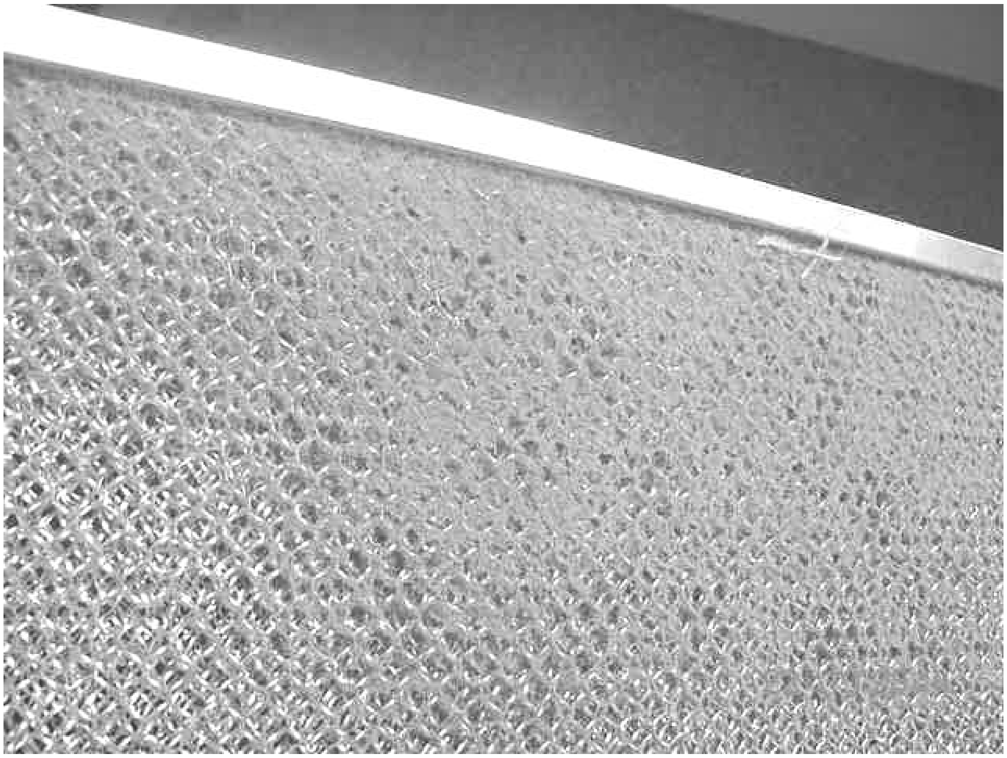
Water Cooler on Carpeting

Picture 12



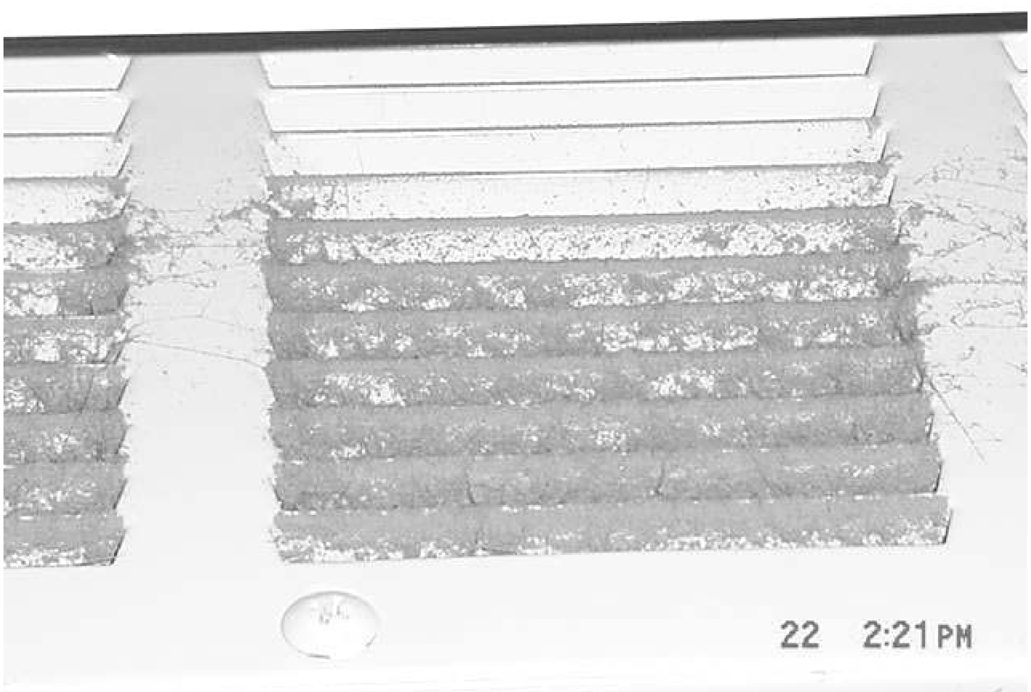
Air Filter on Floor beneath FCU

Picture 13



Metal/Mesh Filter with Accumulated Dust

Picture 14



Dust Accumulation on FCU Air Diffuser

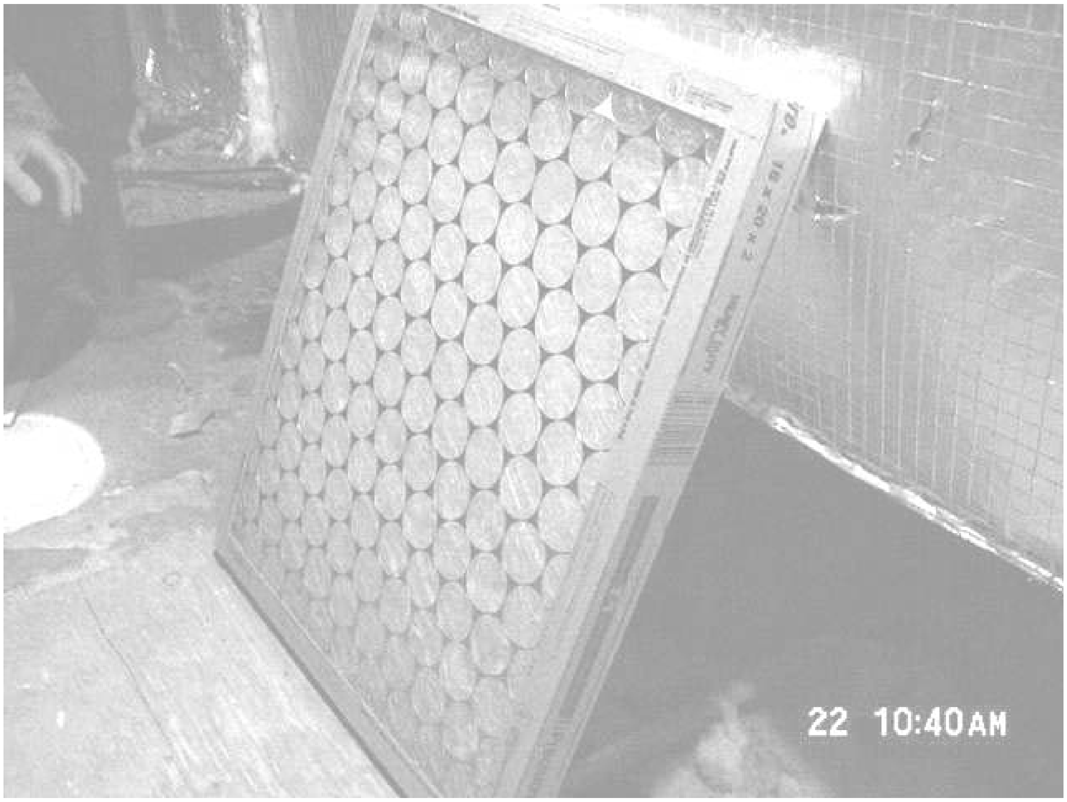
Picture 15

Accumulated Dust on Exhaust Vent

Picture 16

Accumulated Dust on Fan Blades

Picture 17

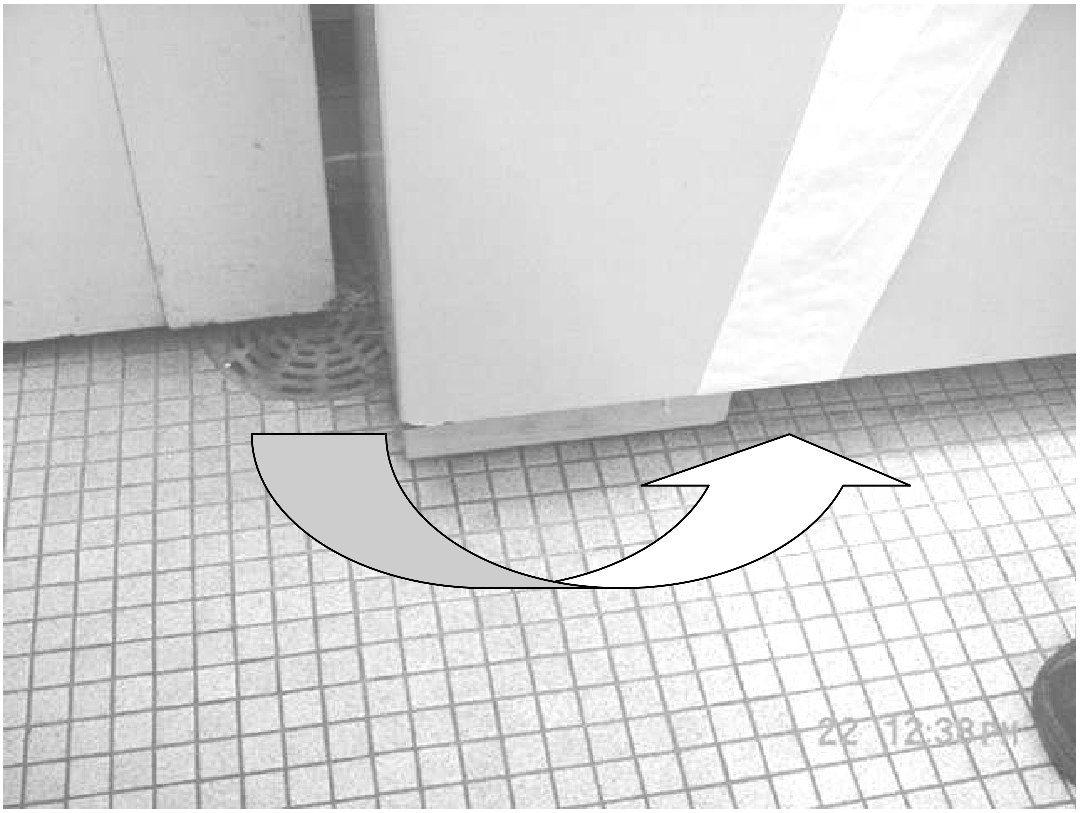


Fiberglass/Mesh (Low Efficiency) Filter in Attic AHU

Picture 18

Fiberglass/Mesh (Low Efficiency) Filter in Attic AHU

Picture 19



Proximity of FCU to Floor Drain in Men's Room, Note Tissue Paper being "Pulled Into" FCU via Return Vent (Arrow Indicates Air Flow)

Picture 20

Missing Ceiling Tile Exposing Fiberglass Insulation

Picture 21

Exposed Fiberglass Pipe Insulation

Picture 22

Open Pipes and Utility Hole in Floor

Figure 1

Fan Coil Unit (FCU)

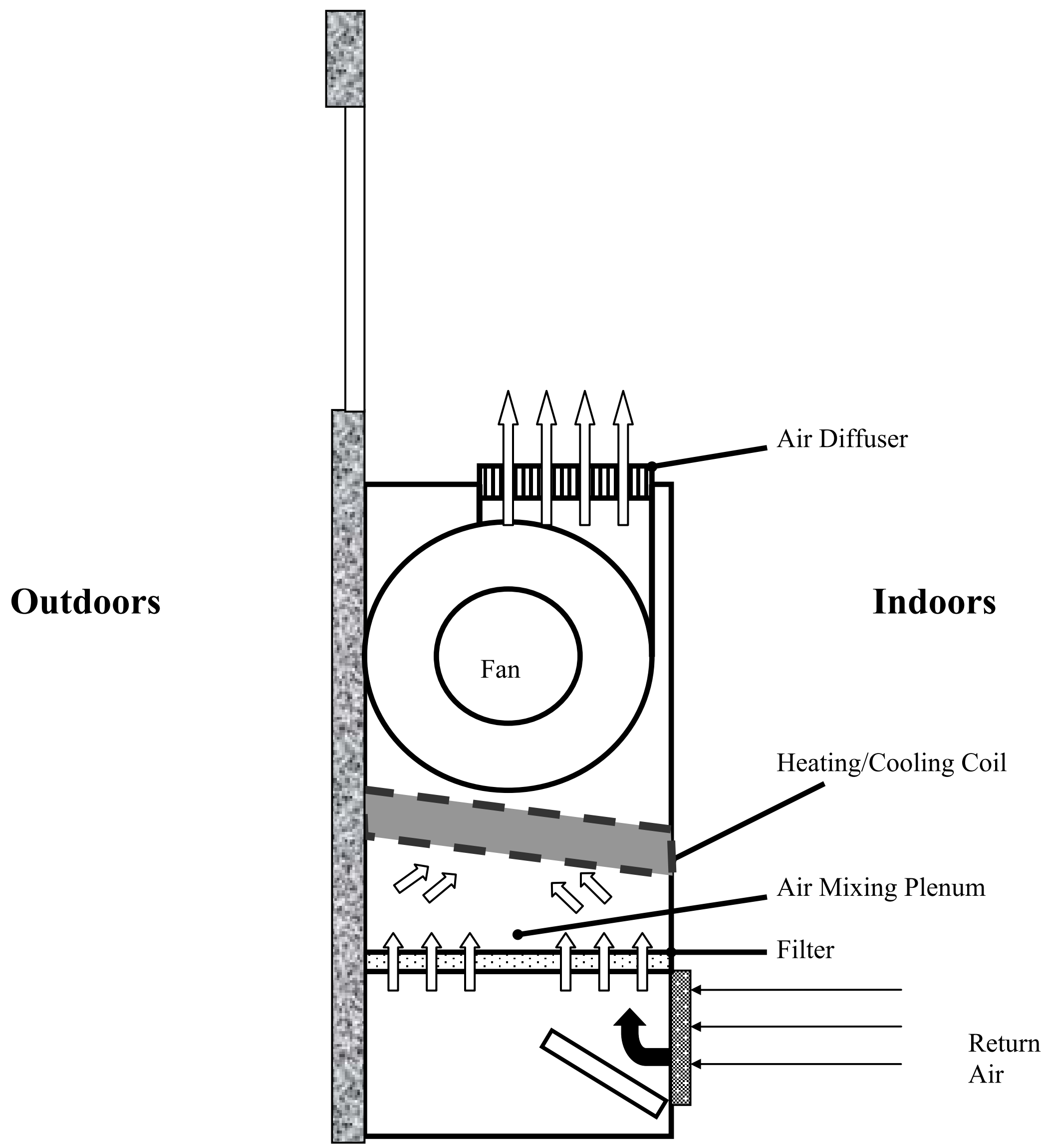


TABLE 1

Indoor Air Test Results – Lexington Town Hall, Lexington, MA – February 22 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Background	383	49	22					Sunny, mild, clear skies
Town Engineer Office	1326	67	30	4	Y	Y	N	FCU-off
DPW/ Engineering	1186	69	30	4	Y	Y	Y	Plants, FCU-off, PF-dusty
202	1168	70	29	0	Y	Y	N	FCU on
Engineering (rear)	1298	72	27	4	Y	Y	Y	Plants, DEM
Lunchroom\ print room	1196	72	27	1	Y	N	N	Missing CT-fiberglass insulation, photo copier, FCU
212 Selectman meeting room	693	69	21	0	Y	Y	Y	DEM, FCU
212-B Board of Selectmen	733	72	21	1	Y	Y	Y	Plants, open utility holes, damaged CTs, FCUs
212-A	722	72	22	0	Y	Y	Y	FCU
220 Town Manager	686	72	21	3	Y	Y	Y	FCU-on, space heater, plants

*** ppm = parts per million parts of air**

CT = ceiling tile
PF = personal fan
DEM = dry erase materials

FCU = fan coil unit
DO = door open
WD = water damage

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

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Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Assistant Town Manager	613	71	20	0	Y	N	N	Space heater, FCU-off, DEM
Lunchroom/ vault	678	71	21	0	N	N	N	
Town Manager	738	72	21	1	Y	Y	N	1 CT, plants, bubbling paint, efflorescence on wall near FCU, hole in wall around electrical outlet
Meeting room	782	72	21	0	Y	N	N	
118 Town Clerk	740	73	20	5	Y	Y	Y	2 missing CTs/6 WD CTs, 1 damaged CT, FCUs-blocked, FCU filter on floor, water cooler on carpet, efflorescence front wall
Town Clerk Office	713	72	19	0	Y	Y	Y	Plants
Men's restroom 1st Floor	522	67	25	0	Y	N	N	Missing/damaged CTs, FCU

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						Supply	Exhaust	
Women's restroom 1st Floor	530	68	24	0	Y	N	N	Missing/damaged CTs, FCU
113 Tax Collector's Office	862	70	24	2	Y	Y	Y	FCUs-blocked/off, missing/damaged CTs along exterior wall, broken window, water cooler on carpet, gypsum wallboard-saturated underneath vinyl coving, carpet water stained-dry
Water Billing	989	70	23	2	Y	Y	Y	Open hole in floor-FCU pipes, damaged CT corner, FCU-off/obstructed
106 Utility Billing	725	71	22	1	N	Y	N	FCU
Mail Room	600	71	21	0	Y	N	N	Photocopier, Missing CTs
105 Finance	810	72	24	3	Y	Y	Y	FCU-blocked, missing CTs
102 Town Accountant	806	73	24	1	Y	Y	N	FCU

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						Supply	Exhaust	
Network Room	652	72	21	0	Y	N	N	FCU
MIS	719	73	20	2	Y	Y	Y	FCU
MIS Director's Office	791	72	22	1	Y	N	N	Missing CTs, FCU
104 Retirement	700	72	20	0	Y	Y	N	FCU-blocked
G-8 Community Development	843	73	22	2	Y	Y	Y	Gypsum wallboard moisture measurement-med/removed coving to dry
BOH Director's Office	741	73	21	0	Y	Y	N	Exposed fiberglass-pipes, FCU
Community Devop Director	843	73	21	0	Y	Y	N	Exposed fiberglass-pipes, FCU
Building Commissioners Office	852	74	22	0	Y	N	N	DEM, FCU-on
Building Inspectors	861	75	22	4	Y	Y	Y	Plants

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						Supply	Exhaust	
G-1 Planning	838	72	22	1	Y	Y	Y	2 missing CTs, plants, FCU-blocked
G-15 Meeting/Lunch room	1109	70	22	1	Y	Y	Y	FCU-on, filter on floor
Janitor's Closet	760	71	24	0	N	N	Y	Local exhaust vent-off
G-25 Recreation	915	72	23	2	Y	Y	Y	WD CT leaks/condensation, FCU-blocked
Recreation Office	1089	74	24	2	Y	Y	N	WD CT's leaks/condensation, fiberglass-pipes, plants
Recreation Assistant Office	866	74	21	1	Y	Y	N	WD CTs, FCU-blocked
Men's Restroom Ground floor	895	75	21	0	N	Y	Y	Passive door vent, FCU over/near floor drain, room pressurized
Woman's Restroom Ground floor	688	72	20	0	Y	N	N	FCU

CT = ceiling tile
PF = personal fan
DEM = dry erase materials

FCU = fan coil unit
DO = door open
WD = water damage

*** ppm = parts per million parts of air**

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems
Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 1

Indoor Air Test Results – Lexington Town Hall, Lexington, MA – February 22 2006

Location	Carbon Dioxide (*ppm)	Temp (°F)	Relative Humidity (%)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Nurse's Office	901	72	24	0	N	Y	Y	FCU, WD wall
G-16 Assessors	908	75	21	3	Y	Y	Y	FCU-blocked, plants, broken window
Assessor's Office	881	75	22	0	Y	Y	N	PF-dusty, space heaters, photocopier
Work out Room	704	67	19	2	N	Y	Y	AHU

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